IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Huang, et al.	§	
	§	Group Art Unit: 2812
Serial No.: 10/765,361	§	
	§	
Confirmation No.: 1559	§	
	§	Examiner: Alexander G. Ghyka
Filed: January 27, 2004	§	
	§	
For: Method of Depositing Low k Films	§	
	§	

MAIL STOP APPEAL BRIEF-PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

APPEAL BRIEF

Applicants submit this Appeal Brief to the Board of Patent Appeals and Interferences on appeal from the decision of the Examiner of Group Art Unit 2812 dated March 23, 2006, finally rejecting claims 1-20. The final rejection of claims 1-20 is appealed. This Appeal Brief is believed to be timely since it is filed by the due date of August 28, 2006, as set by filing a Notice of Appeal on June 28, 2006. Authorization to charge the fee of $500.00 for filing this brief is provided on a separate fee transmittal. Please charge any additional fees that may be required to make this Appeal Brief timely and acceptable to Deposit Account No. 20-0782/APPM/002592.C8/KMT.

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Real Party in Interest

The present application has been assigned to Applied Materials, Inc., 3050 Bowers Avenue, Santa Clara, California 95054.

Related Appeals and Interferences

Applicants assert that no other appeals or interferences are known to the Applicants, the Applicants' legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 1-20 are pending in the application. Claims 1-20 were originally presented in the application. Claims 1, 7, and 15 were amended in the Response to Office Action dated September 30, 2005, that was filed on December 20, 2005. Claims 1-20 stand finally rejected as discussed below. The final rejection of claims 1-20 is appealed. The pending claims are shown in the attached Claims Appendix.

Status of Amendments

All claim amendments have been entered by the Examiner. No amendments to the claims were proposed after the final rejection.

Summary of Claimed Subject Matter

Embodiments of the present invention provide processes for depositing low dielectric constant films. The processes include oxidizing an organosilicon compound to deposit a silicon oxide layer that comprises carbon and has a low dielectric constant (line 1 of paragraph [0016] on page 5-line 5 of paragraph [0016] on page 6, lines 1-2 of paragraph [0017] on page 6).

In the embodiment of independent claim 1, a process for depositing a low dielectric constant film is provided. The process comprises reacting a cyclic organosiloxane with oxygen (paragraph [0020] on pages 7-8, paragraph [0021] on page 8) in the presence of RF power in a chamber (lines 5-9 of paragraph [0016] on page 6, lines 2-3 of paragraph [0022] on page 8) at a pressure of between about 2.5 Torr and about 10 Torr (lines 5-8 of paragraph [0028] on page 11), wherein the oxygen is introduced into the chamber at a flowrate less than or equal to the flowrate of the cyclic organosiloxane into the chamber (lines 2-4 of paragraph [0029] on page 11), and wherein the low dielectric constant film comprises silicon, oxygen, and carbon (lines 1-2 of paragraph [0017] on page 6).

In the embodiment of independent claim 7, a process for depositing a low dielectric constant film is provided. The process comprises reacting a cyclic organosiloxane with oxygen (paragraph [0020] on pages 7-8, paragraph [0021] on page 8) in the presence of mixed frequency RF power in a chamber (lines 2-3 of paragraph [0022] on page 8, paragraph [0040] on pages 14-15, paragraph [0067] on pages 24-25) at a pressure of between about 2.5 Torr and about 10 Torr (lines 5-8 of paragraph [0028] on page 11), wherein the oxygen is introduced into the chamber at a flowrate less than or equal to the flowrate of the cyclic organosiloxane into the chamber (lines 2-4 of paragraph [0029] on page 11), and wherein the low dielectric constant film comprises silicon, oxygen, and carbon (lines 1-2 of paragraph [0017] on page 6).

In the embodiment of independent claim 15, a process for depositing a low dielectric constant film is provided. The process comprises reacting octamethylcyclotetrasiloxane with oxygen (paragraph [0020] on page 8, paragraph [0021] on page 8) in the presence of mixed frequency RF power in a chamber (lines 2-3

of paragraph [0022] on page 8, paragraph [0040] on pages 14-15, paragraph [0067] on pages 24-25) at a pressure of between about 2.5 Torr and about 10 Torr (lines 5-8 of paragraph [0028] on page 11), wherein the oxygen is introduced into the chamber at a flowrate less than or equal to the flowrate of the octamethylcyclotetrasiloxane into the chamber, and the oxygen flowrate is less than or equal to about 200 sccm (lines 1-4 of paragraph [0029] on page 11), and wherein the low dielectric constant film comprises silicon, oxygen, and carbon (lines 1-2 of paragraph [0017] on page 6).

Ground of Rejection to be Reviewed on Appeal

1. Claims 1-20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Foo, et al.* (U.S. Patent No. 5,124,014).

ARGUMENT

1. Argument with respect to the rejection of claims 1-20 under 35 U.S.C. § 103(a) over *Foo, et al.* (U.S. Patent No. 5,124,014).

THE EXAMINER ERRED IN REJECTING CLAIMS 1-20 UNDER 35 U.S.C. § 103(a) BECAUSE *FOO, ET AL.* DOES NOT TEACH OR SUGGEST REACTING A CYCLIC ORGANOSILOXANE WITH OXYGEN IN A CHAMBER, WHEREIN THE OXYGEN IS INTRODUCED INTO THE CHAMBER AT A FLOWRATE LESS THAN OR EQUAL TO THE FLOWRATE OF THE CYCLIC ORGANOSILOXANE INTO THE CHAMBER.

Claims 1-20 stand rejected under 35 U.S.C. § 103(a) over *Foo, et al.* (U.S. Patent No. 5,124,014). The Examiner states that *Foo, et al.* discloses the deposition of a silicon oxide film in the presence of RF power at a pressure of less than 50 mTorr, using octamethylcyclotetrasiloxane, oxygen, and a carrier gas. The Examiner also states that *Foo, et al.* differs from the present claims in that oxygen is not introduced at a flowrate less than or equal to the flowrate of a cyclic organosiloxane into the chamber, and that *Foo, et al.* prefers a higher flowrate of oxygen. The Examiner asserts that it would have been obvious to use a lower flowrate of oxygen as it is not inventive to discover optimum or workable ranges when the general conditions of a claim are disclosed in the prior art. The Examiner further asserts that it would have been obvious to use lower flowrates of oxygen, as adjusting the flowrate is within the skill of one of ordinary skill in the art. Applicants respectfully traverse the rejection.

Foo, et al. provides a method of forming silicon dioxide layers by reacting oxygen with TEOS (tetraethoxysilane) or TMCTS (tetramethylcyclotetrasiloxane) (abstract). *Foo, et al.* teaches that if TEOS is used, the oxygen flowrate should be about twice the TEOS flowrate in order to produce good quality silicon dioxide, and that if TMCTS is used, the oxygen flowrate should be about three times the TMCTS flowrate (column 4, lines 43-47). Applicants note that *Foo, et al.* does not provide or suggest any other embodiments, preferred or otherwise, for cyclic organosiloxane and oxygen flowrates

besides the one embodiment that specifies that the oxygen flowrate should be about three times the TMCTS flowrate. Applicants submit that *Foo, et al.'s* teaching that the oxygen flowrate should be about three times the TMCTS flowrate does not suggest, motivate, or provide a reasonable expectation of success for using a flowrate for oxygen that is lower than or equal to a cyclic organosiloxane (TMCTS) flowrate to deposit a silicon oxide film that includes carbon and has a low dielectric constant.

Regarding the Examiner's assertion that it would have been obvious for one of ordinary skill in the art to use a lower oxygen flowrate, as adjusting the oxygen flowrate is within the skill of one of ordinary skill in the art, Applicants respectfully submit that a finding that the claimed invention is within the capabilities of one of ordinary skill in the art is not sufficient to establish a case of *prima facie* obviousness in the absence of a suggestion or motivation to modify the flowrates of *Foo, et al.* to obtain the claimed flowrates (MPEP § 2143.01 section IV, MPEP § 2143).

Regarding the Examiner's assertions that *Foo, et al.'s* language regarding a higher oxygen flowrate than TMCTS flowrate does not exclude other flowrates (See Advisory Action dated June 7, 2006), and that *Foo, et al.* is not limited to any flowrates (See Advisory Action dated June 30, 2006), Applicants respectfully submit that optimization requires selecting slightly improved conditions within a defined range and that *Foo, et al.* does not define a range that includes using an oxygen flow rate that is less than or equal to a TMCTS or other cyclic organosiloxane flow rate.

Thus, *Foo, et al.* does not teach, show, or suggest a process for depositing a low dielectric constant film, comprising reacting a cyclic organosiloxane with oxygen in the presence of RF power in a chamber at a pressure of between about 2.5 Torr and about 10 Torr, wherein the oxygen is introduced into the chamber at a flowrate less than or equal to the flowrate of the cyclic organosiloxane into the chamber, and wherein the low dielectric constant film comprises silicon, oxygen, and carbon, as recited in claim 1. Applicants respectfully request withdrawal of the rejection of claim 1 and of claims 2-6, which depend thereon.

Similarly, *Foo, et al.* does not teach, show, or suggest a process for depositing a low dielectric constant film, comprising reacting a cyclic organosiloxane with oxygen in the presence of mixed frequency RF power in a chamber at a pressure of between

about 2.5 Torr and about 10 Torr, wherein the oxygen is introduced into the chamber at a flowrate less than or equal to the flowrate of the cyclic organosiloxane into the chamber, and wherein the low dielectric constant film comprises silicon, oxygen, and carbon, as recited in claim 7. Applicants respectfully request withdrawal of the rejection of claim 7 and of claims 8-14, which depend thereon.

Furthermore, *Foo, et al.* does not teach, show, or suggest a process for depositing a low dielectric constant film, comprising reacting octamethylcyclotetrasiloxane with oxygen in the presence of mixed frequency RF power in a chamber at a pressure of between about 2.5 Torr and about 10 Torr, wherein the oxygen is introduced into the chamber at a flowrate less than or equal to the flowrate of the octamethylcyclotetrasiloxane into the chamber, and the oxygen flowrate is less than or equal to about 200 sccm, and wherein the low dielectric constant film comprises silicon, oxygen, and carbon, as recited in claim 15. Applicants respectfully request withdrawal of the rejection of claim 15 and of claims 16-20, which depend thereon.

CONCLUSION

In conclusion, *Foo, et al.*, does not teach, show, or suggest a process for depositing a low dielectric constant film, comprising reacting a cyclic organosiloxane with oxygen in a chamber, wherein the oxygen is introduced into the chamber at a flowrate less than or equal to the flowrate of the cyclic organosiloxane into the chamber. Therefore, it is believed that the rejections made by the Examiner should be reversed. Thus, Applicants respectfully request reversal of the rejection and allowance of claims 1-20.

Respectfully submitted,

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CLAIMS APPENDIX

1. (Previously Presented) A process for depositing a low dielectric constant film, comprising reacting a cyclic organosiloxane with oxygen in the presence of RF power in a chamber at a pressure of between about 2.5 Torr and about 10 Torr, wherein the oxygen is introduced into the chamber at a flowrate less than or equal to the flowrate of the cyclic organosiloxane into the chamber, and wherein the low dielectric constant film comprises silicon, oxygen, and carbon.

2. (Original) The process of claim 1, wherein the cyclic organosiloxane is selected from the group consisting of 1,3,5,7-tetramethylcyclotetrasiloxane, octamethylcyclotetrasiloxane, 1,3,5,7,9-pentamethylcyclopentasiloxane, 1,3,5,7-tetrasilano-2,6-dioxy-4,8-dimethylene, 2,4,6-trisilanetetrahydropyran, and 2,5-disilanetetrahydrofuran.

3. (Original) The process of claim 1, wherein the cyclic organosiloxane is octamethylcyclotetrasiloxane.

4. (Original) The process of claim 1, wherein the oxygen is introduced into the chamber at a flowrate of about 100 sccm to about 200 sccm.

5. (Original) The process of claim 1, further comprising introducing a carrier gas into the chamber.

6. (Original) The process of claim 1, wherein a carrier gas is introduced into the chamber at a flow rate between about 0 sccm and about 1000 sccm.

7. (Previously Presented) A process for depositing a low dielectric constant film, comprising reacting a cyclic organosiloxane with oxygen in the presence of mixed frequency RF power in a chamber at a pressure of between about 2.5 Torr and about 10 Torr, wherein the oxygen is introduced into the chamber at a flowrate less than or

equal to the flowrate of the cyclic organosiloxane into the chamber, and wherein the low dielectric constant film comprises silicon, oxygen, and carbon.

8. (Original) The process of claim 7, wherein the cyclic organosiloxane is selected from the group consisting of 1,3,5,7-tetramethylcyclotetrasiloxane, octamethylcyclotetrasiloxane, 1,3,5,7,9-pentamethylcyclopentasiloxane, 1,3,5,7-tetrasilano-2,6-dioxy-4,8-dimethylene, 2,4,6-trisilanetetrahydropyran, and 2,5-disilanetetrahydrofuran.

9. (Original) The process of claim 7, wherein the cyclic organosiloxane is octamethylcyclotetrasiloxane.

10. (Original) The process of claim 7, wherein the oxygen is introduced into the chamber at a flowrate of about 100 sccm to about 200 sccm.

11. (Original) The process of claim 7, wherein the mixed frequency RF power comprises a high frequency power of 13.56 MHz and a low frequency RF power of about 350 KHz to 1 MHz.

12. (Original) The process of claim 11, wherein the high frequency power is delivered at between about 10 W and about 1000 W and the low frequency power is delivered at between about 0 W and about 500 W.

13. (Original) The process of claim 11, wherein the high frequency power is delivered at between about 300 W and about 1000 W.

14. (Original) The process of claim 7, further comprising introducing a carrier gas into the chamber at a flowrate between about 0 sccm and about 1000 sccm.

15. (Previously Presented) A process for depositing a low dielectric constant film, comprising reacting octamethylcyclotetrasiloxane with oxygen in the presence of mixed

frequency RF power in a chamber at a pressure of between about 2.5 Torr and about 10 Torr, wherein the oxygen is introduced into the chamber at a flowrate less than or equal to the flowrate of the octamethylcyclotetrasiloxane into the chamber, and the oxygen flowrate is less than or equal to about 200 sccm, and wherein the low dielectric constant film comprises silicon, oxygen, and carbon.

16. (Original) The process of claim 15, wherein the oxygen flowrate is about 100 sccm to about 200 sccm.

17. (Original) The process of claim 15, wherein the oxygen flowrate is about 100 sccm.

18. (Original) The process of claim 15, wherein the mixed frequency RF power comprises a high frequency power of 13.56 MHz and a low frequency RF power of about 350 KHz to 1 MHz.

19. (Original) The process of claim 18, wherein the high frequency power is delivered at between about 300 W and about 1000 W.

20. (Original) The process of claim 15, further comprising introducing a carrier gas into the chamber.

EVIDENCE APPENDIX

No evidence is attached.

RELATED PROCEEDINGS APPENDIX

No copies of decisions rendered by a court or the Board in a related appeal or interference are included as no related appeals or interferences have been identified.